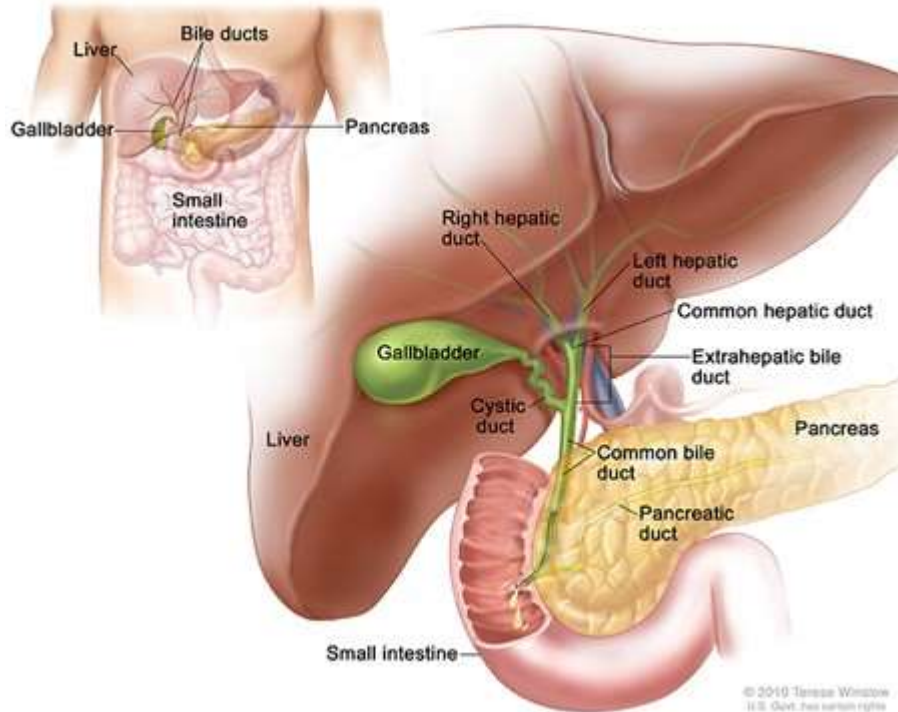


Approach to the Patient with Disease of the Hepatobiliary Tract and Pancreas

LECTURE IN INTERNAL MEDICINE PROPAEDEUTICS

M. Yabluchansky, L. Bogun, L.Martymianova, O. Bychkova, N. Lysenko, N. Makienko
V.N. Karazin National University Medical School' Internal Medicine Dept.

Plan of the lecture



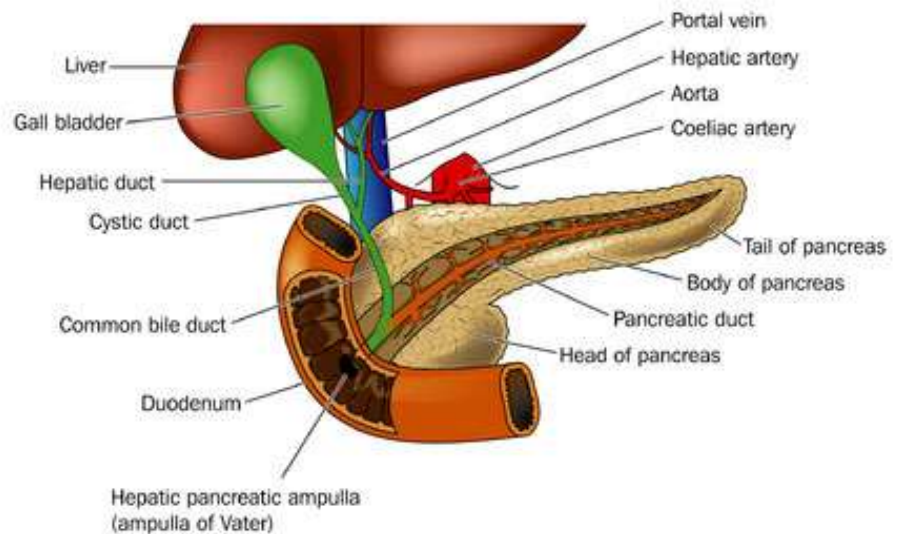
Approach to the Patient with Disease of the Hepatobiliary Tract and Pancreas

- The Hepatobiliary Tract and Pancreas components
- Interviewing of the patient
- Physical examination of the patient
- Instrumental methods
- laboratory methods

The Hepatobiliary Tract and Pancreas components

The Hepatobiliary Tract and Pancreas components:

- Liver
- Biliary tract
- Gall bladder
- Pancreas
- Hepatic pancreatic ampulla



Interviewing of the patient: Good questions to get started on the core interview



- Communication skills:
- Active listening
- Empathy
- Building rapport
- Open-ended questions
- Leading questions
- Silence
- “Why” questions
- Nonverbal communication cues

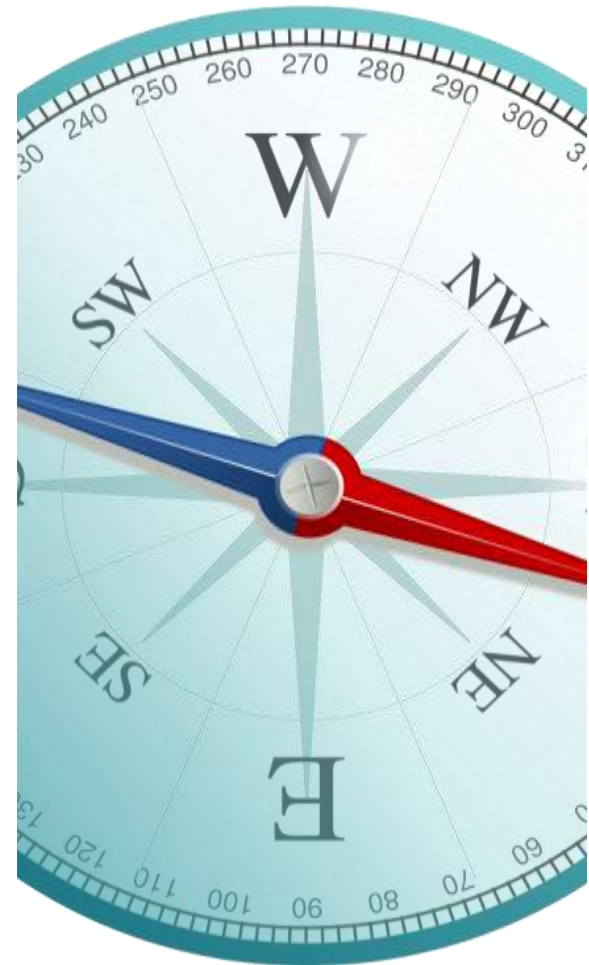
Interviewing of the patient: Good questions to get started on the core interview

- What is your chief complaint?
- Tell me why you're here today
- Tell me about your injury
- What can I do to help you?
- Explain to me your understanding of your injury



Interviewing of the patient: Patient profile

- Age
- Sex
- Race/Ethnicity
- Handedness
- Ht-Wt-BMI-Body type
- Primary language
- Barriers to learning
- Learning preference
- Unique rehabilitation goals



Interviewing of the patient: chief complaints of liver disease

- Fatigue ,malaise
- Anorexia
- Disordered taste and smell
- Nausea and vomiting
- Alteration in body weight
- Pain
- RUQ pain (hepatomegaly, biliary colic)
- Jaundice
- Alteration in bowel function
- Varices
- Arthralgia, myalgia
- Urticaria
- Headaches
- Pale stools and dark urine
- Edema and ascites
- Cholestatic pruritus
- Bruising (petechiae, ecchymosis)
- Bleeding
- Muscle wasting
- Xanthomas and xanthelasmas
- Fever
- Sexual dysfunction
- Muscle cramps
- Mental disorders (somnolence, agitation, delirium)

Interviewing of the patient: fatigue in liver disease

- Fatigue is one of the most common and debilitating symptoms among individuals with liver disease
- In some patients, fatigue begins several years after the diagnosis of liver disease is made and in others, it was the primary reason for seeking medical attention
- Fatigue may occur at any time of day but is most common in the morning about an hour after awakening and even little tasks become more trying and around 4 p.m., they simply must lie down to take a nap

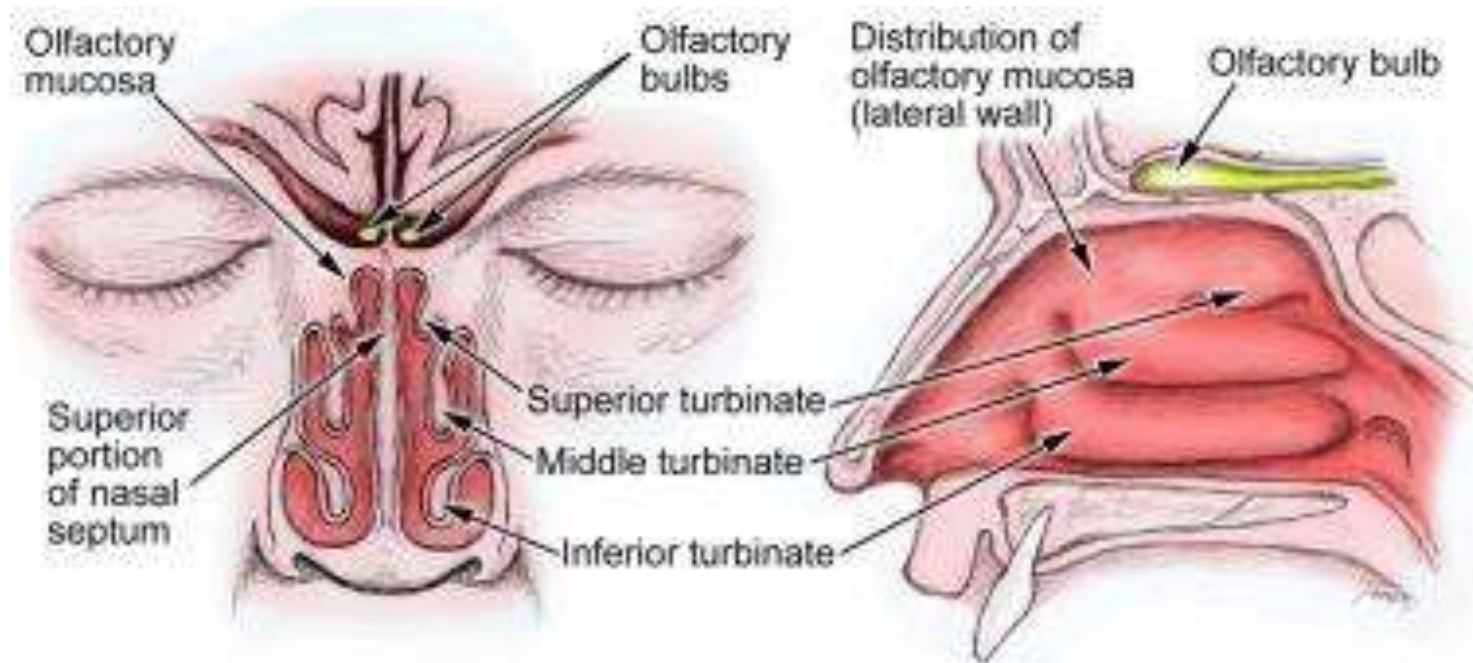


Interviewing of the patient: anorexia in liver disease

- Anorexia, is an eating disorder characterized by a low weight, fear of gaining weight, a strong desire to be thin, and food restriction
- Anorexia often begins following a severe liver disease
- The diagnosis requires a significantly low weight
- In adults the severity of anorexia is based on body mass index (BMI):
 - a BMI of greater than 17 – mild
 - a BMI of 15 to 16 - moderate
 - a BMI less than 15 – severe



Interviewing of the patient: disordered taste and smell in liver disease



- The chemical senses (taste and smell) enable us to use chemical signals to communicate with the environment and each other
- Both acute and chronic liver disease can alter smell and taste function (aversion to cigarettes is common in acute viral hepatitis)

Interviewing of the patient: nausea and vomiting in liver disease

- Nausea is the unpleasant urge to vomit
- Vomiting is the forceful ejection of stomach contents through the mouth
- This is generally a protective mechanism to remove harmful ingested substances, but can occur from many unrelated pathologic conditions including liver disease
- Vomiting must be differentiated from regurgitation, which is the effortless movement of swallowed food contents or stomach acid from the stomach back into the mouth



Interviewing of the patient: alteration in body weight in liver disease



- Unintentional weight losses commonly seen in patients with chronic liver diseases
- Mechanisms include anorexia, early satiety due to pressure of ascites on the stomach, and accelerated metabolism

Interviewing of the patient: pain in liver disease

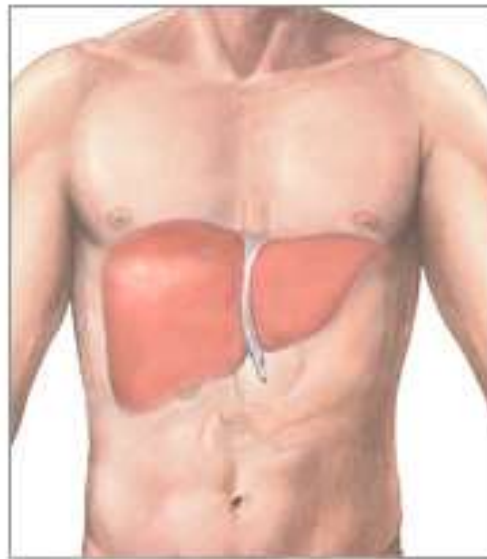
- Pain and discomfort may be felt in the upper right side of the abdomen where the liver is located
- Pain may be caused by the liver growing in size due to the accumulation of fat, acute inflammation or any injury that can expand and stretch the sensitive membrane covering the liver



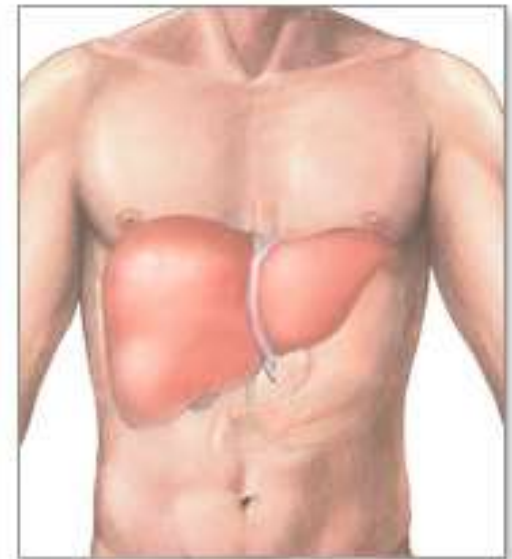
Interviewing of the patient: hepatomegaly in liver disease

- Liver disease can disrupt blood flow in the liver or cause tumors (benign or malignant) to develop, which adds to the mass of the liver
- Some of the most common causes of hepatomegaly are metastatic cancer, fatty liver disease and cirrhosis

Normal liver



Enlarged liver due to hepatomegaly



 ADAM.

Interviewing of the patient: jaundice in liver disease

- Jaundice is indicated by a yellowing of the skin, whites of the eyes and mucus membranes
- This is caused by the damaged liver failing to adequately process bilirubin, the waste product that occurs when old red blood cells are broken down
- An excess of bilirubin accumulates in the blood and deposits in the skin, which causes the yellowish



Interviewing of the patient: alteration in bowel function in liver disease

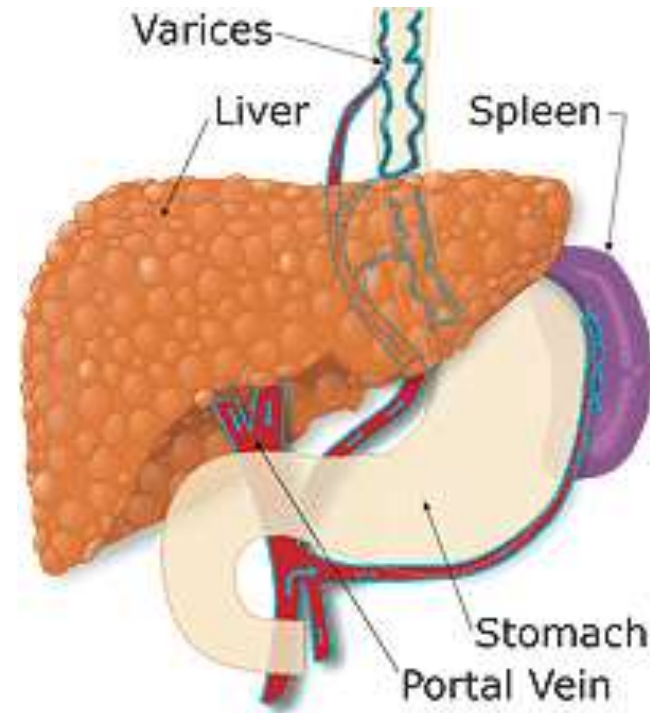
- Abnormal changes in the color of your stool can include:
 - black, tarry stools
 - clay-colored stools
 - deep red stools
 - white-colored stools
- Changes in the consistency of stool include:
 - dry stools
 - hard stools
 - mucus or fluid that leaks out around the stool
 - watery, loose stools (known as diarrhea)



Interviewing of the patient: portal hypertension in liver disease

- Portal hypertension is elevated pressure in the portal vein
- Causes:
 - pre-sinusoidal (e.g. portal vein thrombosis, Schistosomiasis, sarcoidosis)
 - sinusoidal (e.g. cirrhosis, alcoholic hepatitis)
 - post-sinusoidal (e.g. right-sided heart failure, hepatic vein thrombosis, veno-occlusive disease, constrictive pericarditis)
- Consequences include hepatic encephalopathy (feto hepaticus), ascites, varices, Caput medusae

Normal portal pressure is 5 to 10 mm Hg (7 to 14 cm H₂O), which exceeds inferior vena caval pressure by 4 to 5 mm Hg (portal venous gradient) and higher values are defined as portal hypertension



Interviewing of the patient: edema and ascites in liver disease

- Ascites is a gastroenterological term for an accumulation of fluid in the peritoneal cavity
- Ascites is also known as peritoneal cavity fluid, peritoneal fluid excess, hydroperitoneum or more archaically as abdominal dropsy
- Although most commonly occurs due to cirrhosis, severe liver disease or metastatic cancer, its presence can portend other significant medical problems, such as Budd–Chiari syndrome



Interviewing of the patient: caput medusae

- The term Caput Medusae describes the appearance of distended and engorged umbilical veins which are seen radiating from the umbilicus across the abdomen to join systemic veins.
- The name originates from the apparent similarity to Medusa's hair once Minerva had turned it into snakes.
- It is a sign of severe portal hypertension with portal-systemic shunting through the umbilical veins.



Interviewing of the patient: cholestatic pruritus in liver disease

Cholestatic pruritus is the sensation of itch due to nearly any liver disease, but the most commonly associated entities are primary biliary cirrhosis, primary sclerosing cholangitis, obstructive choledocholithiasis, carcinoma of the bile duct, cholestasis (also see drug-induced pruritus), and chronic hepatitis C viral infection and other forms of viral hepatitis



Interviewing of the patient: coagulopathy in liver disease

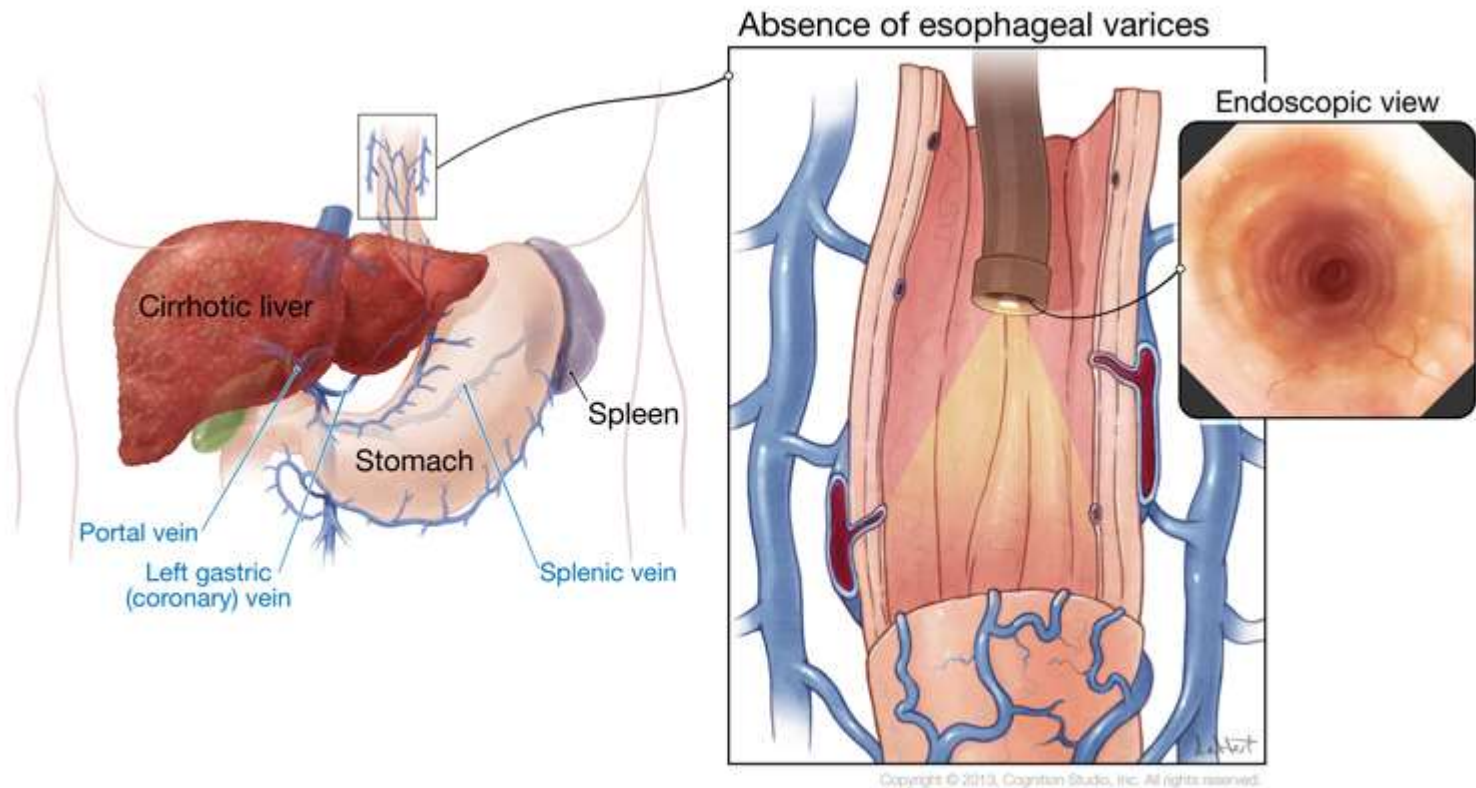
- Chronic liver disease is characterized by decreased levels of most procoagulant factors, with the notable exceptions of factor VIII and von Willebrand factor, which are elevated
- Decreased levels of the procoagulants are, however, accompanied by decreases in levels of such occurring anticoagulants as antithrombin and protein C



Interviewing of the patient: bleeding in liver disease

- In severe liver scarring (cirrhosis), the normal flow of blood through the liver may become impaired
- Blood from the intestines may then be re-routed around the liver through small vessels primarily in the stomach and esophagus
- Some of these blood vessels may become quite large and swollen; they are known as varices
- Varices can occur anywhere within the gastrointestinal tract, but occur most commonly in the esophagus and stomach
- Due to high pressure (portal hypertension) and thinning of the walls of varices, they may rupture, causing bleeding within the upper gastrointestinal tract

Interviewing of the patient: bleeding in liver disease



Interviewing of the patient: fever in liver disease

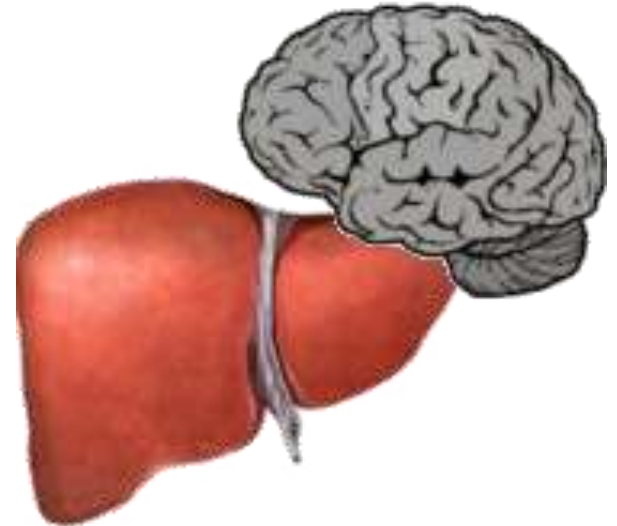
Occurrence of fever in a patient with liver diseases should suggest the following:

- Endotoxemia
- Infections
- Alcoholic hepatitis
- Hepatoma



Interviewing of the patient: hepatic encephalopathy in liver disease

- Hepatic encephalopathy refers to a decline in brain function that occurs as a result of toxic substances (ammonia, free fatty acids, mercaptans and false neurotransmitters) accumulating in the brain because the liver is no longer able to effectively eliminate them
- This complication of cirrhosis can lead to symptoms such as confusion, loss of short-term memory and even loss of consciousness
- In the advanced stages it is called hepatic coma or coma hepaticum
- Hepatic encephalopathy may ultimately lead to death
- Hepatic encephalopathy is reversible with treatment



The only pathognomonic finding is fetor hepaticus (musty odor of breath due to sulphur-containing compounds)

Interviewing of the patient: sexual dysfunction in liver disease



Any male (testicular atrophy) or female (amenorrhea) with chronic liver disease is at risk for experiencing sexual dysfunction

<http://www.liversupport.com/sexual-dysfunction/who-is-at-risk-for-sexual-dysfunction/>
http://40.media.tumblr.com/fd23c8cc68475a64d39196dd69cac860/tumblr_inline_nqg0rgQl4C1ts69xw_500.jpg

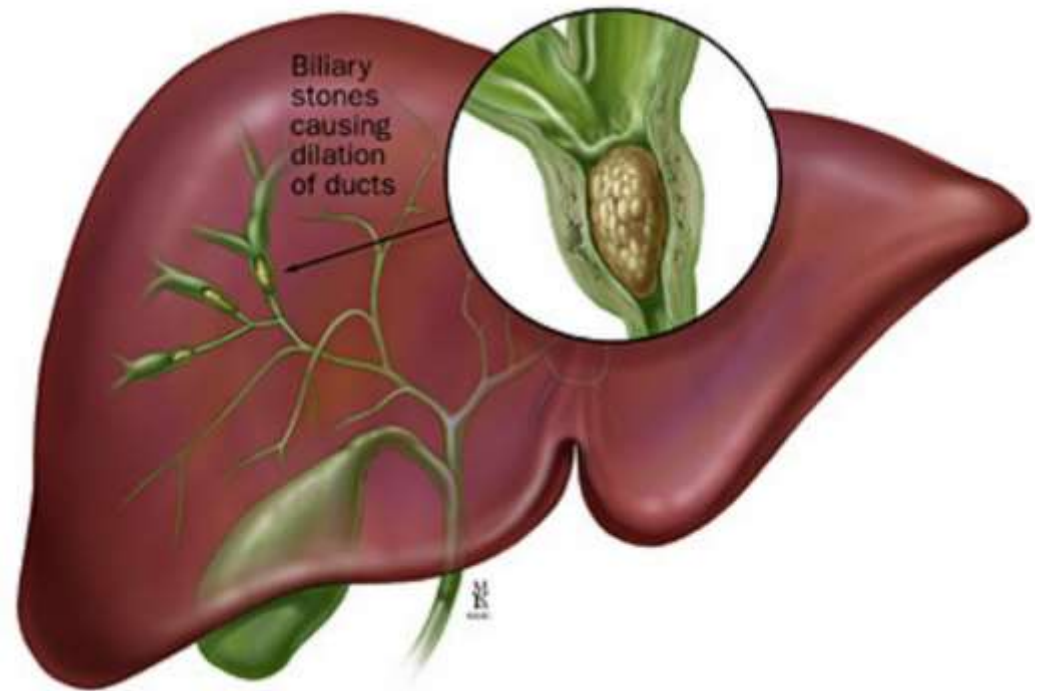
Interviewing of the patient: muscle cramps in liver disease



- Muscle cramps are common in patients with liver disease and adversely influence quality of life
- The exact mechanisms by which they occur remain unclear, although a number of pathophysiological events unique to liver disease may contribute
- Clinical studies have identified alterations in 3 areas: nerve function, energy metabolism, and plasma volume/electrolytes

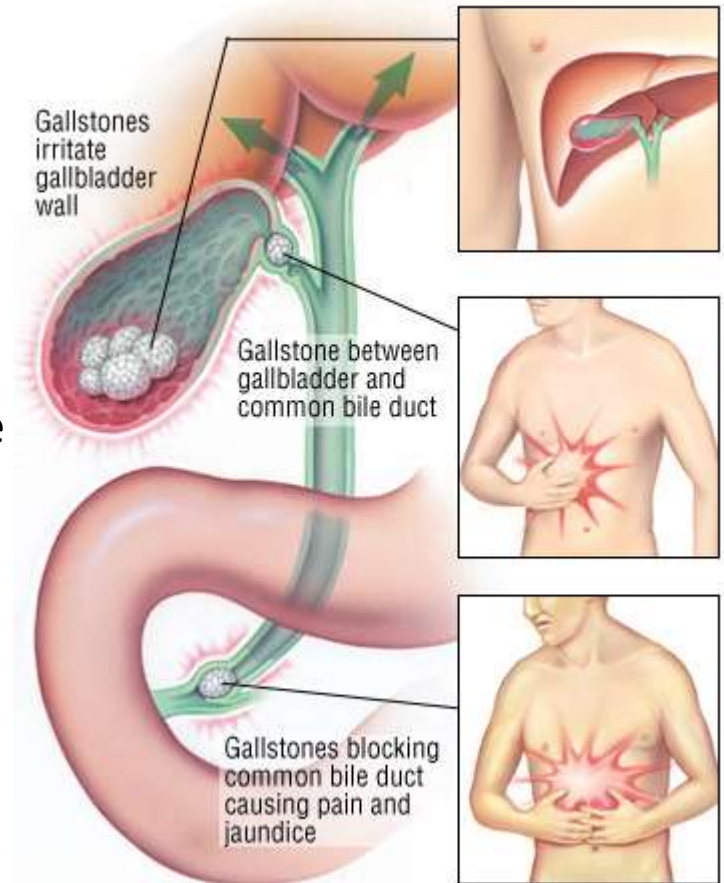
Interviewing of the patient: chief complaints in biliary disease

- Pain
- Jaundice
- Pruritus
- Fatigue
- Weight loss
- Gallstones and Bile Duct Stones
- Miscellaneous



Interviewing of the patient: pain in biliary disease

- The upper abdominal penetrating or tightness pain, typically severe and located in the epigastrium
- The pain may develop suddenly, last for 15 minutes to several hours, and then resolve suddenly
- The pain is caused by an obstruction to the flow of bile, with distension of the biliary lumen, and is clinically similar to when the obstruction occurs at the cystic duct or at another level of the common bile duct
- As noxious visceral stimuli become more intense, referred pain may be experienced in the posterior scapula or right shoulder area and be accompanied by nausea and vomiting



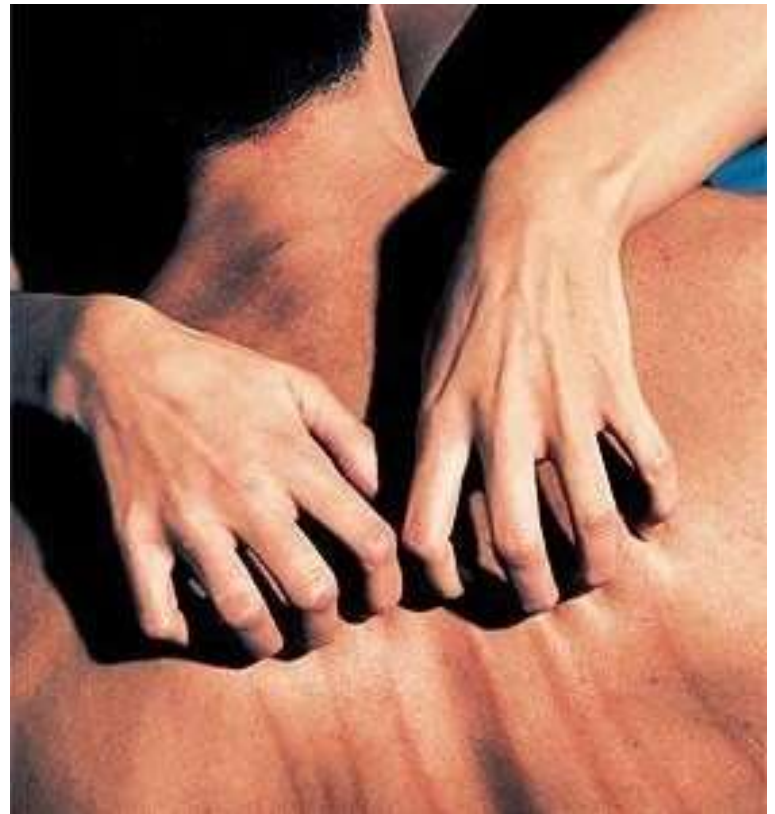
Interviewing of the patient: jaundice in biliary disease

- Bilirubin metabolism and transport principally are handled by the hepatobiliary tract
- A yellow discoloration of the skin begins to appear when serum bilirubin rises above 3 mg/dL, and the yellow discoloration is termed jaundice
- Abnormalities leading to jaundice may occur in various phases of the process



Interviewing of the patient: pruritus in biliary disease

- Itching is an unpleasant sensation in the skin associated with a strong desire to scratch
- While several causes exist, itching is associated with cholestasis and may become the patient's most bothersome symptom
- Itching may appear first in the hands and feet, but it usually becomes generalized and typically is worse at night
- Itching does not distinguish the cause of cholestasis as hepatic or biliary



Interviewing of the patient: fatigue in biliary disease

The insidious onset of fatigue, followed by pruritus and then jaundice, is observed to varying degrees in diseases of the intrahepatic bile ducts, such as primary biliary cirrhosis, primary sclerosing cholangitis, and vanishing bile duct syndrome



Interviewing of the patient: weight loss in biliary disease

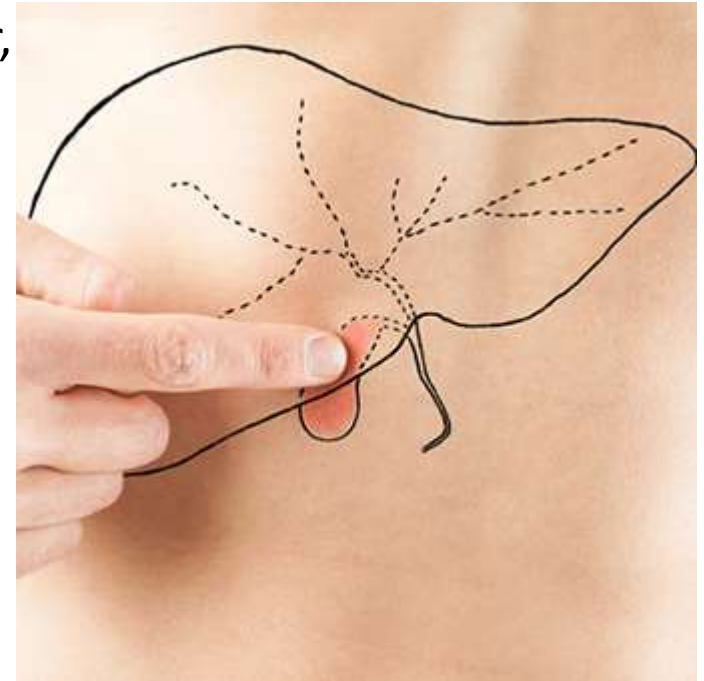
- A history of weight loss is associated with more serious diseases of the biliary tract
- The weight loss may be caused by inadequate nutrient intake (eg, anorexia) or malabsorption of fats (eg, a paucity of bile in cholestatic diseases or prolonged biliary obstruction)



Interviewing of the patient: gallstones and bile duct stones in biliary disease

Nature:

- Gallstones, which are created in the gallbladder, form when substances in the bile create hard, crystal-like particles
- Cholesterol stones (80%), as the name implies, are made of cholesterol and appear light in color and eighty percent of gallstones are formed this way
- Pigment stones (20%) are small, dark stones made of bilirubin and calcium salts that are found in bile
- Risk factors for pigment stones include cirrhosis of the liver, biliary tract infections, hereditary blood cell disorders (such as sickle cell anemia)
- Bile duct stones are gallbladder stones that have become lodged in the bile duct



Interviewing of the patient: miscellaneous in biliary disease

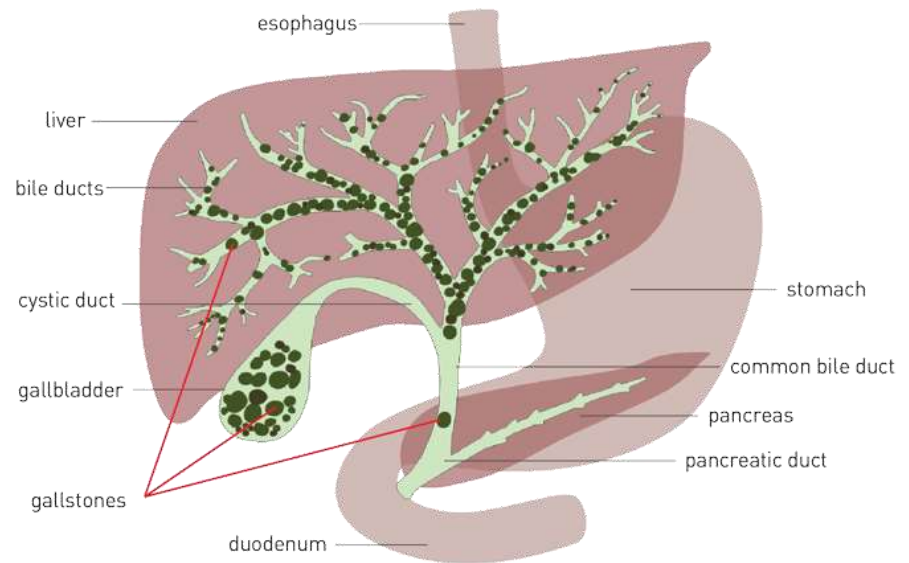


Other symptoms, including fatty food intolerance, gas, bloating, and dyspepsia, do not reliably indicate the presence of biliary tract disease

Interviewing of the patient: gallstones and bile duct stones in biliary disease

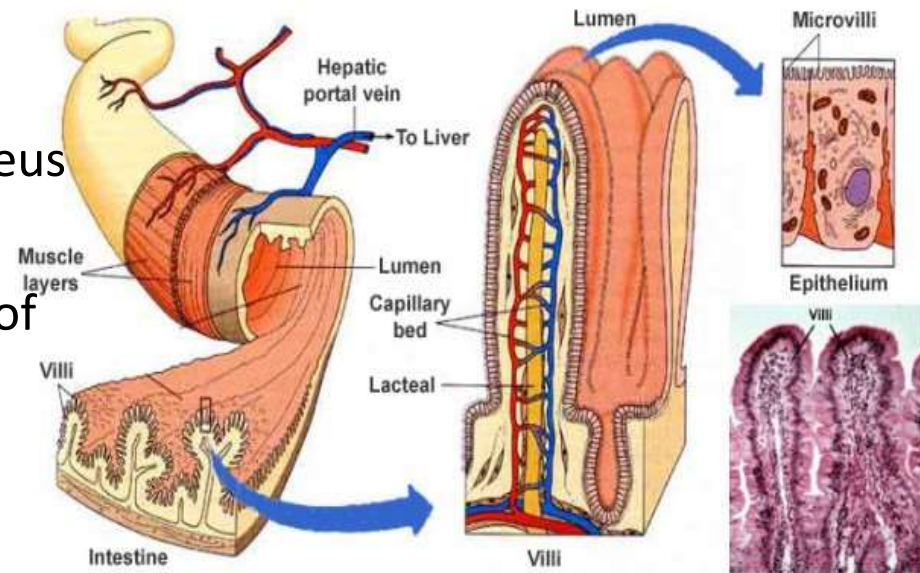
Symptoms:

- Acute colic pain possibly very severe, that occurs very suddenly (pain may last a few minutes, or many hours; pain is usually located behind your breastbone, but may occur in the upper right abdominal area; pain between shoulder-blades is another symptom of gallstones)
- Chills and fever
- Jaundice
- Nausea and vomiting

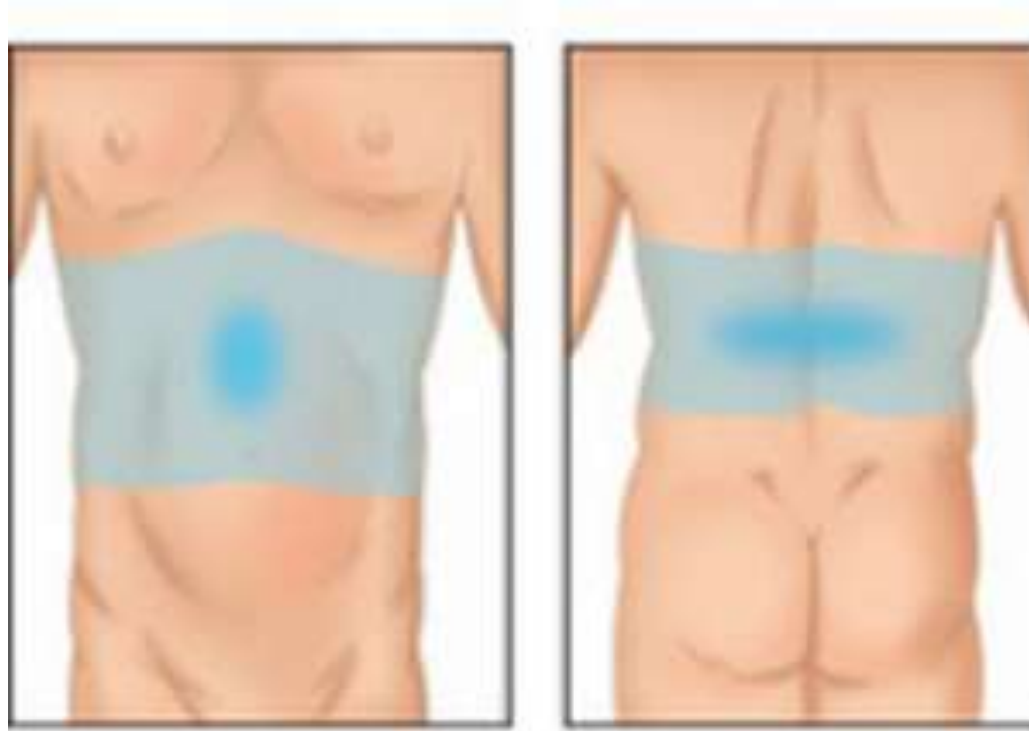


Interviewing of the patient: chief complaints in pancreatic disease

- Upper abdominal pain
- Nausea and vomiting
- Abdominal distension from paralytic ileus
- Fever: chemical, not due to infection
- Jaundice: compression or obstruction of bile duct
- Tetany: transient hypocalcemia
- Malabsorption
- Diabetes
- Losing weight without trying
- Oily, smelly stools (steatorrhea)
- Tenderness when touching the abdomen
- Miscellaneous



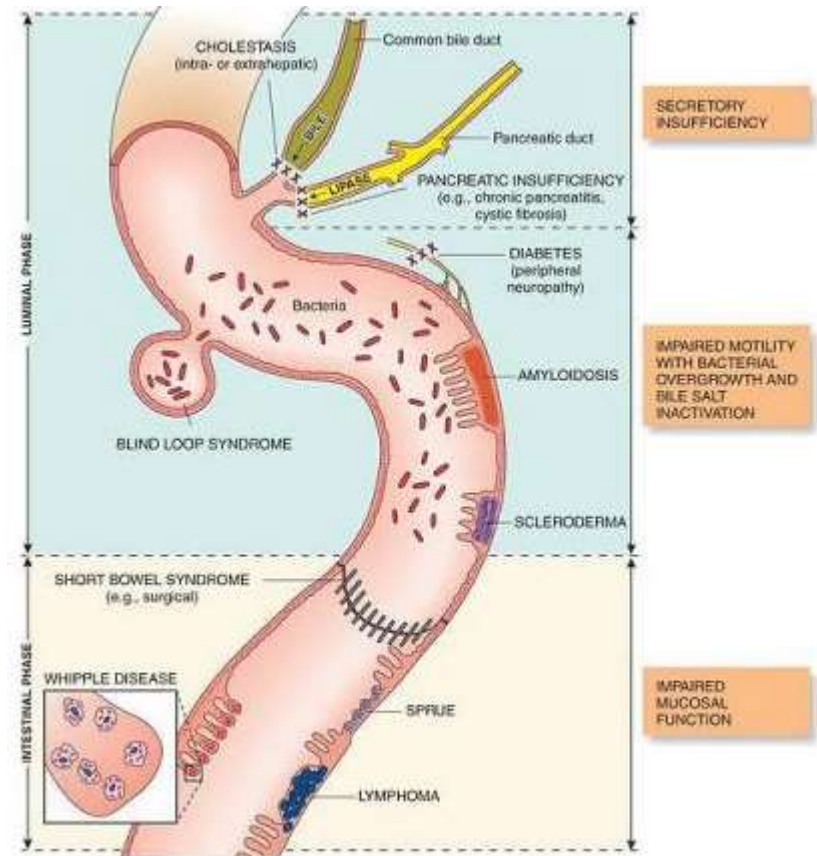
Interviewing of the patient: pain in pancreatic disease



- Upper abdominal noncolicky, constant pain (in epigastric region) radiates to left back , feels worse after eating and when patient is lying down, may improve when leaning forward (Inglefinger's sign)
- Pain may last for a few minutes to several hours at a time

Interviewing of the patient: malabsorption in pancreatic disease

- Malabsorption is a state arising from abnormality in absorption of food nutrients across the gastrointestinal (GI) tract
- Impairment can be of single or multiple nutrients depending on the abnormality
- This may lead to malnutrition and a variety of anaemias
- Normally the human gastrointestinal tract digests and absorbs dietary nutrients with remarkable efficiency



Interviewing of the patient: diabetes in pancreatic disease

- The pancreas has a considerable reserve of islet beta cells, and need to excise 70–90% from healthy condition before they will develop diabetes
- Extensive pancreatic damage (severe cases of acute pancreatitis, chronic pancreatitis, pancreatic fibrosis (due for example to iron overload), following surgical excision of the pancreas, pancreatic carcinoma) is needed to cause diabetes
- Pancreatic diabetes results in loss of both insulin and pancreatic glucagon, diabetic ketoacidosis is rare, and patients are sensitive to the action of insulin.

Interviewing of the patient: steatorrhea in pancreatic disease

- Steatorrhea (steatorrhoea) is the presence of excess fat in feces
- Stools may also float due to excess gas, have an oily appearance and can be especially foul-smelling
- An oily anal leakage or some level of fecal incontinence may occur
- There is increased fat excretion, which can be measured by determining the fecal fat level
- The definition of how much fecal fat constitutes steatorrhea has not been standardized



Interviewing of the patient: Chief complaints’ “red flags”

- Fever
- Acute/persistent diarrhea
- Persistent constipation
- Blood in stools (tarry stool)
- Persistent nausea or vomiting
- Vomiting blood
- Severe tenderness of the belly
- Unintended weight loss
- Symptom onset after age 50



- Dysphagia
- Anorexia or early satiety
- Jaundice
- Palpable abdominal mass
- Rectal bleeding

Interviewing of the patient: specific questions for set of chief complaints

Each of chief complaints will prompt a series of specific questions that will help arrive at a preliminary single diagnosis, or a group of different diagnoses



Interviewing of the patient: example of specific questions in chief complaint

- Character
- Location
- Severity
- Timing
- Duration
- Radiation
- Provocation
- Relieving conditions
- When did it first start?
- How often does it occur?
- Is appetite good or has it changed?
- What brought it on?
- Were there associated symptoms
- Is it becoming more frequent with time?
- Are the symptoms lasting longer?
- How the symptoms relate to food intake?

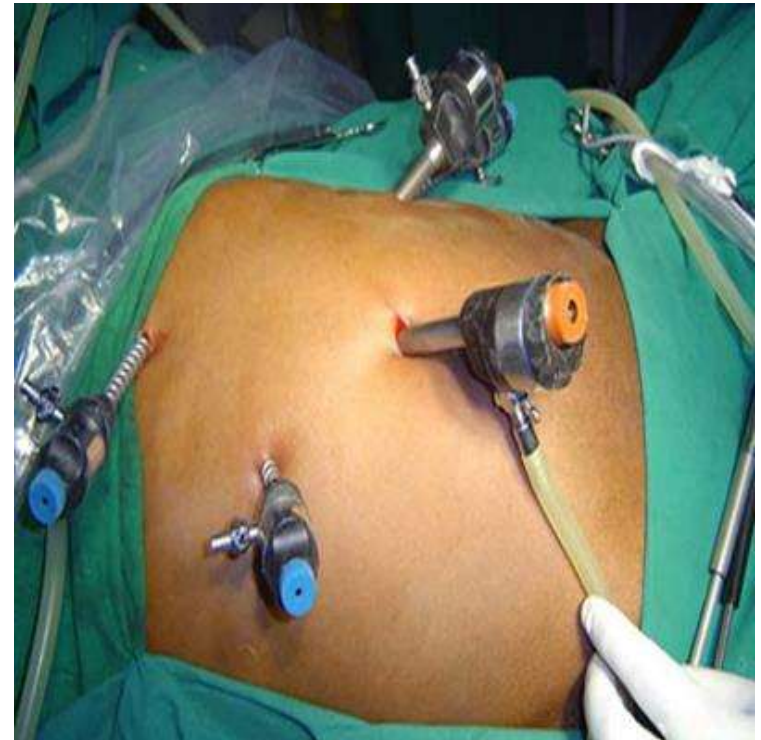
Interviewing of the patient: past medical history

In a medical encounter, a past medical history (abbreviated PMH), is the total sum of a patient's health status prior to the presenting problem

The image shows a close-up of a medical form titled "Past Medical History". The form is divided into sections for different medical conditions. The "Cardiac" section includes options: ☐ None, ☐ Unknown, ☐ Angina, ☐ Arrhythmia, ☐ Cardiomyopathy, ☐ CHF, ☐ Congenital, ☐ Implanted Defib, and ☐ Other. To the right, there are more options: ☐ None, ☐ Unknown, ☐ Abdominal, ☐ Heart, and ☐ Lung. Below the Cardiac section, there is a section for "Chronic Illnesses" with options for "sis/Renal" and "intestinal". A black pen is resting on the form, pointing towards the Cardiac section. Other parts of the form visible include "State", "Secondary Insurance", and "Secondary Insurance".

Interviewing of the patient: prior or current treatment

- Diet
- Medications
- Surgery
- Injections
- Chiropractic
- Exercise/PT (Physical Therapy)
- ER (Emergency Room)
- Massage therapy



Interviewing of the patient: previous treatment and present status

- Previous Treatment
 - What?
 - Where?
 - When?
 - By whom?
- Present Status
 - Better vs. same vs. worse



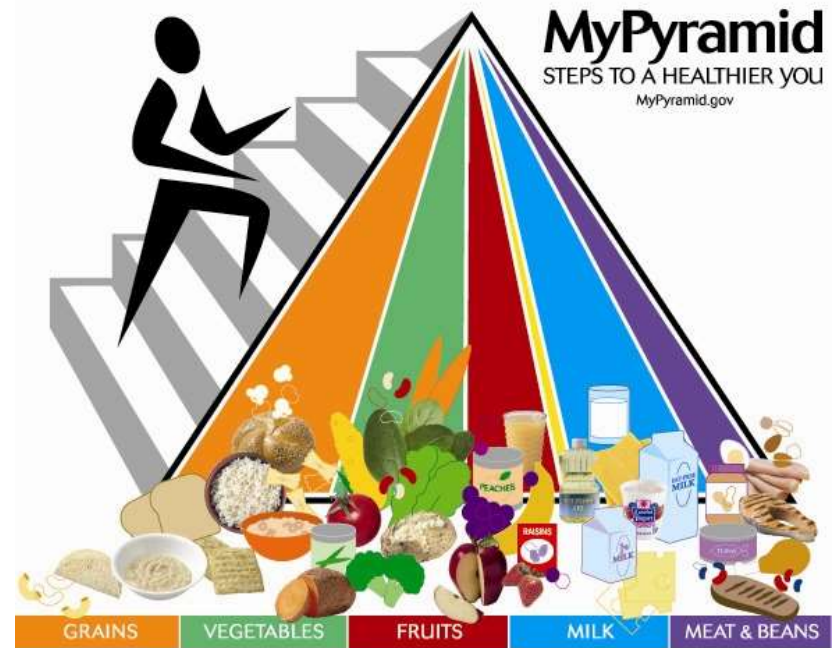
Interviewing of the patient: family history and genetic risk

- Certain gastrointestinal, liver, hepatobiliary and pancreas illnesses may occur in more than one member of a family
- The physician will inquire about the health of the patient's parents, brothers, sisters and children



Interviewing of the patient: diet history

- A diet history is important when assessing gastrointestinal, liver, hepatobiliary and pancreas illnesses
- Many conditions manifest themselves as a result of alterations in dietary intake and absorption of nutrients



Interviewing of the patient: social history

- High-risk behaviors
 - Alcohol, tobacco, or drug abuse
 - Depression
 - Diet
 - Anorexia/bulimia
 - Sedentary lifestyle
- Signs of any of the above behaviors may warrant referral to a secondary provider



Interviewing of the patient: why take a medical history?

- Up 90% of conditions can be accurately diagnosed or recognized by conducting a thorough medical history and listening carefully to the patient's response(s)
- Determines the necessary tests and measures you should prioritize for your objective examination



Interviewing of the patient: review of systems

- The "laundry list" of symptoms related to various organs of the body
- A series of questions helps seek out information that the patient may have neglected to provide the physician
- Review of systems helps to identify the patient's problem, or exclude different parts of the differential diagnosis



Interviewing of the patient: systemic enquiry

- General: fever, weight loss, loss of appetite, lethargy
- Respiratory and cardiovascular systems: shortness of breath, cough, hemoptysis, wheeze, chest pain
- Genito-urinary system: dysuria (pain on passing urine), frequency, terminal dribbling, urethral discharge
- Gynecological system: pelvic pain, vaginal bleeding, vaginal discharge, LMP
- Neurological system: headaches, dizziness, loss of consciousness, fits, faints, funny turns, numbness, tingling, weakness, problems speaking, change in vision

Interviewing of the patient: Liver, Hepatobiliary and Pancreas Quality of Life Indexes

- The Liver, Hepatobiliary and Pancreas of Life Indexes are a questionnaires which measures Quality of Life these types of patients
- Indexes are a multidimensional constructs with several dimensions: emotional or psychological well being, physical functioning, social functioning, and symptoms of the disease and treatment
- A single item is also included that identifies perceived change in health, making the Indexes a useful indicators for change in Liver, Hepatobiliary and Pancreas Quality of Life Indexes over time and treatment

Physical examination of the patient: from general inspection to abdomen examination

- General inspection from the end of the bed
- General examination of:
 - Hands / pulse
 - Face
 - Lymph nodes
- Examination of the abdomen
 - Inspection
 - Palpation
 - Percussion
 - Auscultation



Physical examination of the patient: positioning

Step	Position
Inspection	Supine, head and knees supported
Auscultation	Supine, head and knees supported
Palpation	Supine, head and knees supported
Percussion	Supine, head and knees supported
Check for ascites	Supine, may need to roll patient for shifting dullness
Rectal examination	Left lateral decubitus
Inguinal examination	Standing

Physical examination of the patient: general inspection

- Whether patient is comfortable at rest
- Do patient appears to be tachypnoeic
- Are there any obvious patient' skin color changes
- Are there any obvious medical appliances around the bed (such as patient controlled analgesia)
- Are there any medications around (although this is unlikely as all medications should be in a locked cupboard)
- Skin: bronze or grey (due to melanin, not iron) in hemochromatosis
- Bruising (petechiae, ecchymosis) - hepatocellular dysfunction
- Muscle wasting - hepatocellular dysfunction
- Xanthomas and xanthelasmas - hepatocellular dysfunction
- Asterixis – in portal hypertension



Physical examination of the patient: hands inspection

- Temperature
- Skin turgor for hydration
- Koilonychias
- Leukonychia
- Nail clubbing
- Pale nails
- Palmar erythema
- Nicotine staining
- Dupuytren's contracture
- Peripheral cyanosis
- radial pulse



Physical examination of the patient: face inspection

Eyes:

- Pale conjunctiva of anaemia
- Yellow sclera of jaundice
- Kayser-Fleischer rings (copper in Descemet's membranes) in Wilson's disease

Parotid hypertrophy - hepatocellular dysfunction

Changes to the tongue e.g. glossitis, macroglossia, ulcers, candidiasis



Physical examination of the patient: neck inspection

- Palpate for enlarged lymph nodes, first from the front, then back/right
- A palpable enlarged supraclavicular (Virchow's) node is known as Troisier's Sign which drains the thoracic duct, enlargement of this node may suggest metastatic deposits from a malignancy in any of these areas

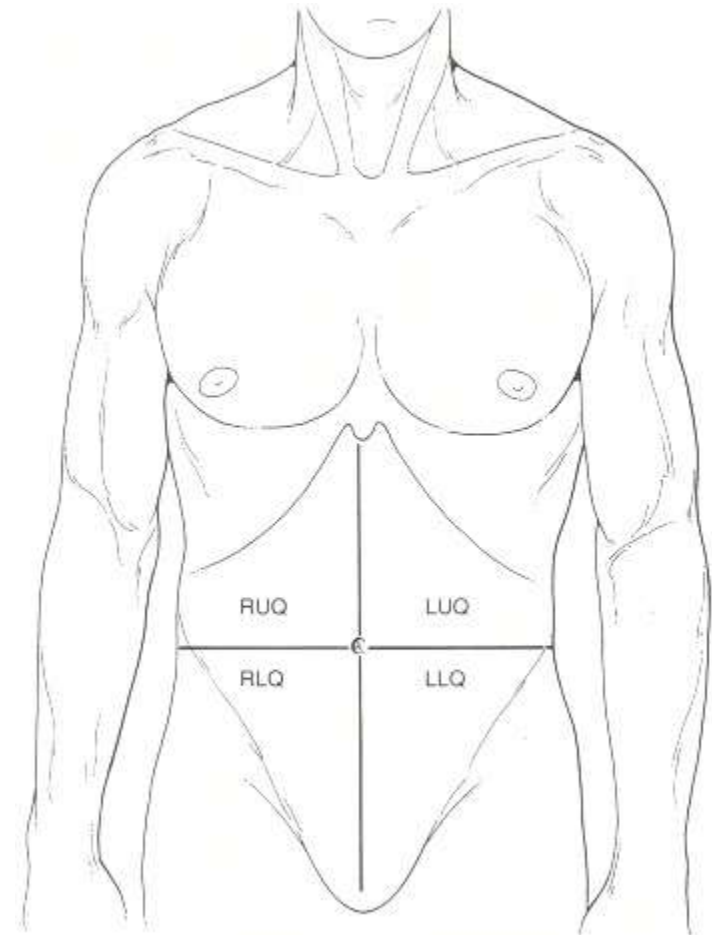
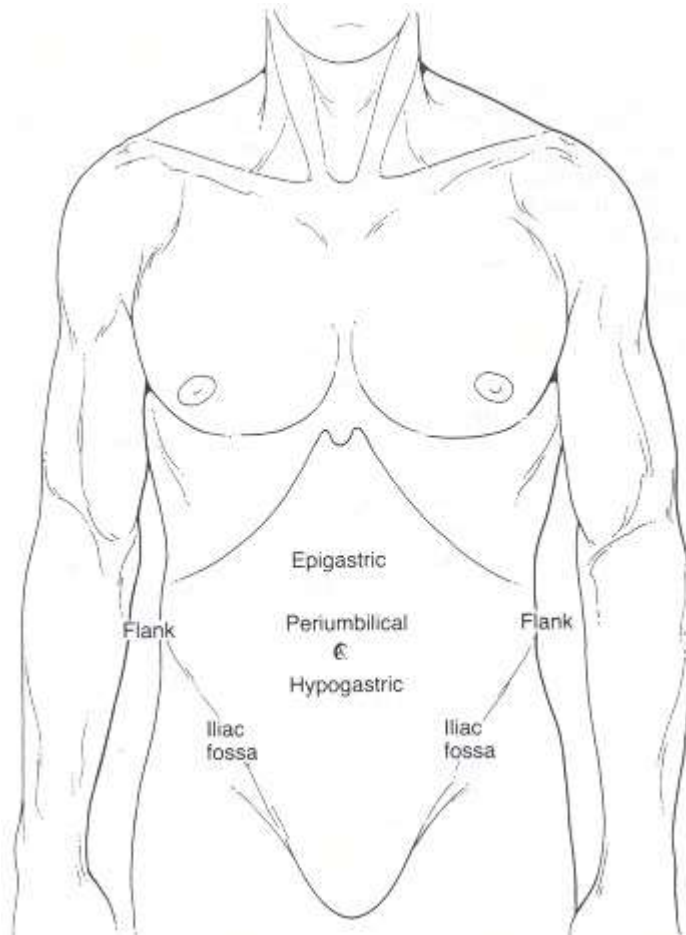


Physical examination of the patient: chest inspection

- gynaecomastia in men
- the presence of 5 or more spider naevi
- pectoral alopecia



Physical examination of the patient: abdominal areas and quadrants



Physical examination of the patient: abdomen inspection

- Scars
- Abdominal distension
- Focal swelling
- Asymmetry
- Dilated/prominent veins
- Visible peristalsis
- Obvious pulsation
- Skin discoloration
- Location and nature of any surgical stomas



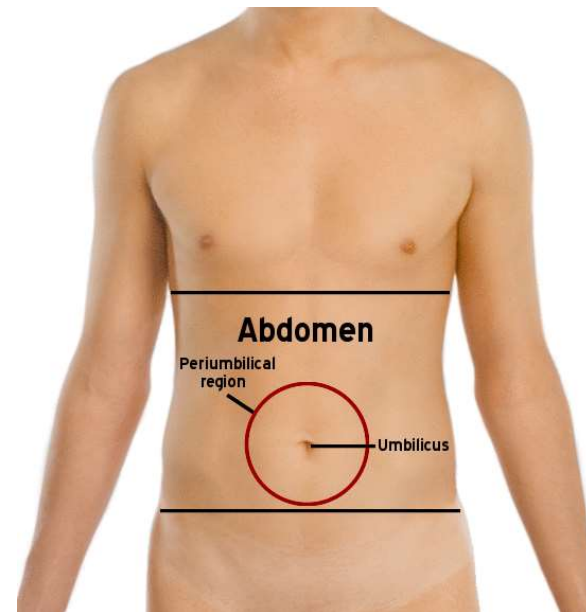
Physical examination of the patient: abdomen auscultation

- Auscultation for bowel sounds may be carried out before percussion and palpation due to adverse effect that these procedures may have on the sound from the bowels
- Bowel sounds listen with the diaphragm of the stethoscope just for up to 30 seconds below the umbilicus (normal, 'tinkling', absent)
- High pitched or absent sounds may indicate bowel obstruction
- Absence of sounds may be also be caused by peritonitis



Physical examination of the patient: abdomen light palpation

- Gently palpate all nine areas
- Start away from known pain
- If there is pain on light palpation, try and determine if this is rebound tenderness



Physical examination of the patient: abdomen deep palpation

- Note any masses or structural abnormality
- Masses should be described in terms of site, size, shape, surface, consistency, mobility, movement with respiration, tenderness and pulsatility
- Splenomegaly



Physical examination of the patient: abdomen percussion

- You should percuss any lumps or masses identified on palpation to determine their size and nature
- Percuss individual organs to help determine their size
- If the abdomen appears distended and you suspect the presence of ascites test for 'shifting dullness' and 'fluid thrill'
- Ascites - clinically detectable when > 500 mL (bulging flanks, shifting dullness, fluid wave)



Physical examination of the patient: the clinical features of liver disease

This patient has chronic liver disease, note:

- jaundice
- wasted muscles with distended abdomen caused by accumulation of ascites
- distended veins in abdominal wall caused by portal hypertension (arrow)
- spider naevi (arrowheads)



Instrumental methods: imaging tests of the liver, gallbladder and pancreas

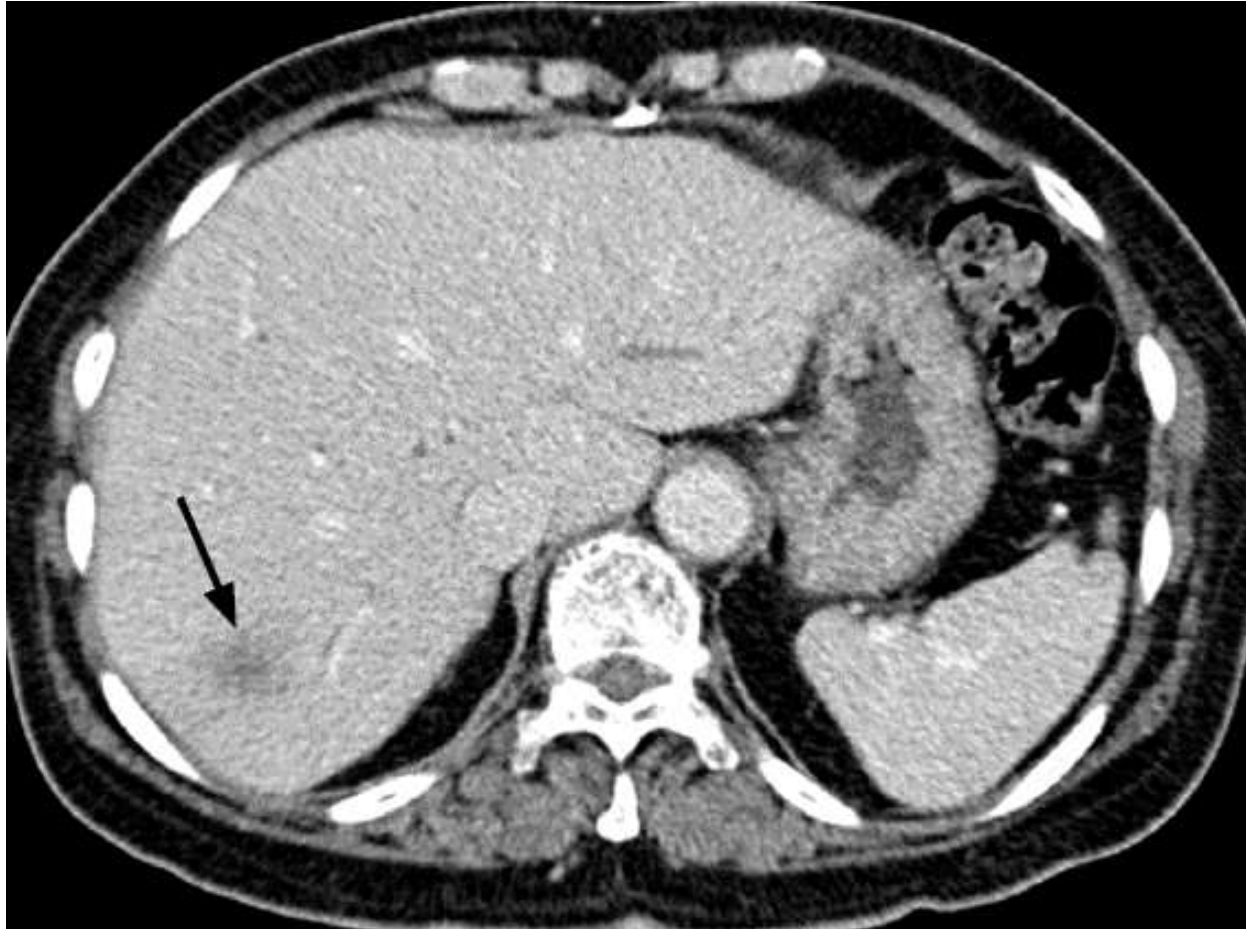
- Ultrasonography
- Doppler ultrasonography
- CT
- Cholescintigraphy
- Radionuclide liver scanning
- Plain x-ray of the abdomen
- MRI
- Endoscopic retrograde cholangiopancreatography (ERCP)
- Percutaneous transhepatic cholangiography (PTC)
- Operative cholangiography

Instrumental methods: flat-plate film of the abdomen



These two radiographs show the importance of including the diaphragm on the plain-film abdomen x-ray

Instrumental methods: computed tomography



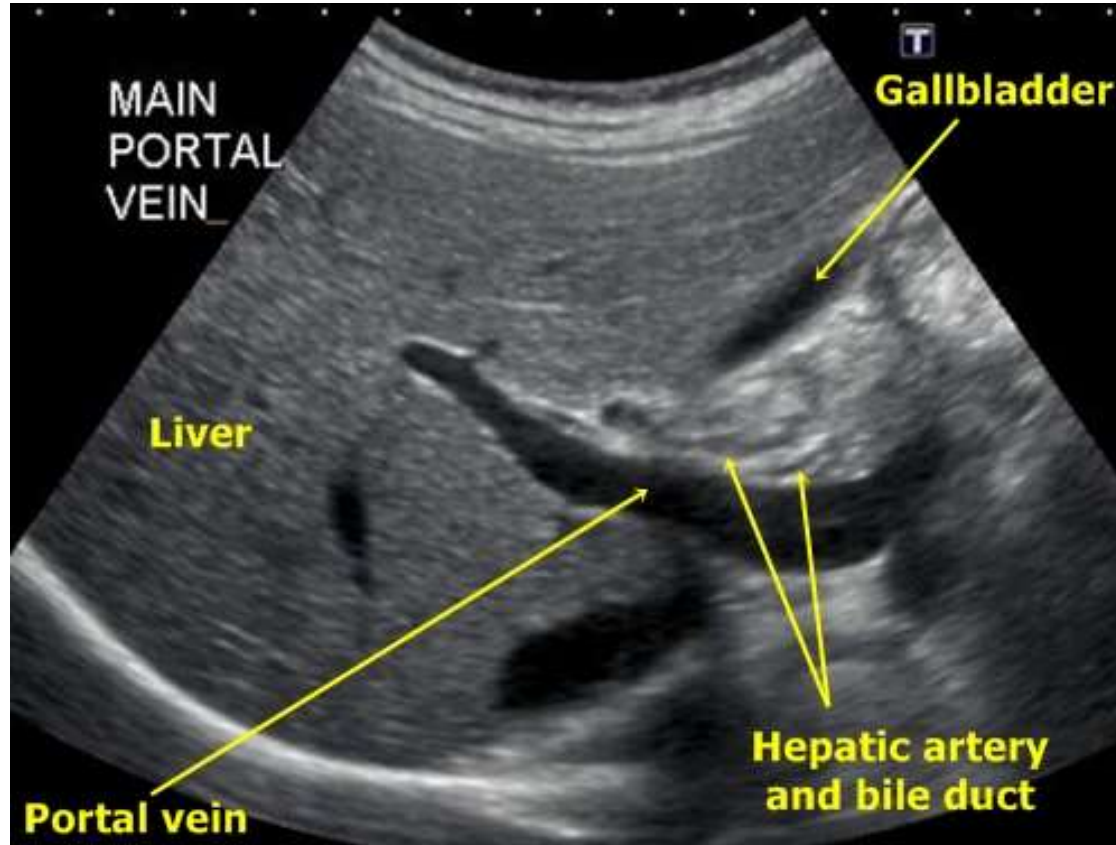
The hypo-attenuating lesion in segment 7 of the liver

Instrumental methods: magnetic resonance imaging



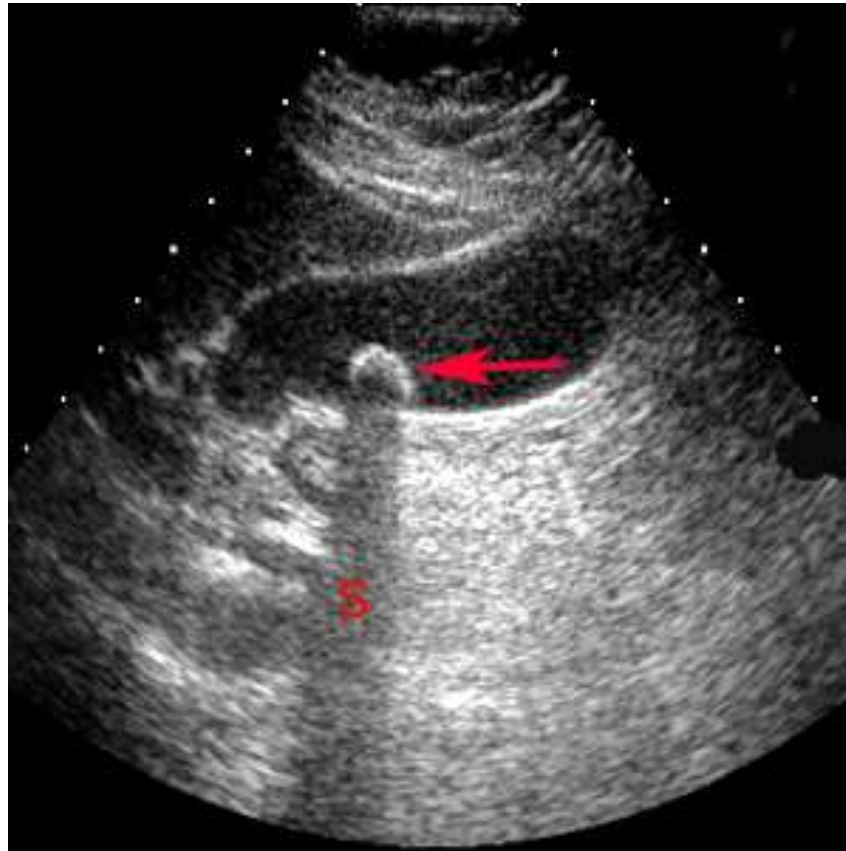
A hypervascular nodular lesion in the right liver lobe

Instrumental methods: abdominal ultrasonography



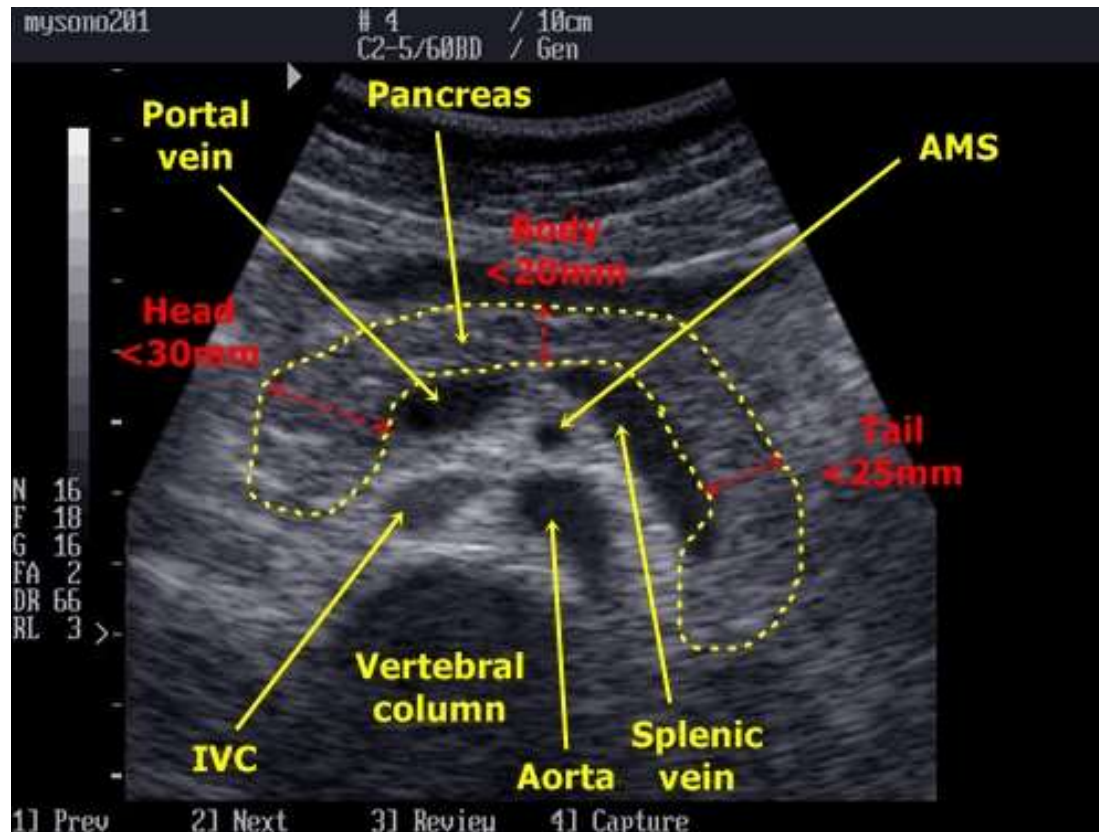
In liver hilum we see portal vein entering the liver; two slim lines above portal vein is hepatic artery and bile duct; in this static picture without the possibility to check the blood flow it is practically impossible to differentiate them

Instrumental methods: abdominal ultrasonography



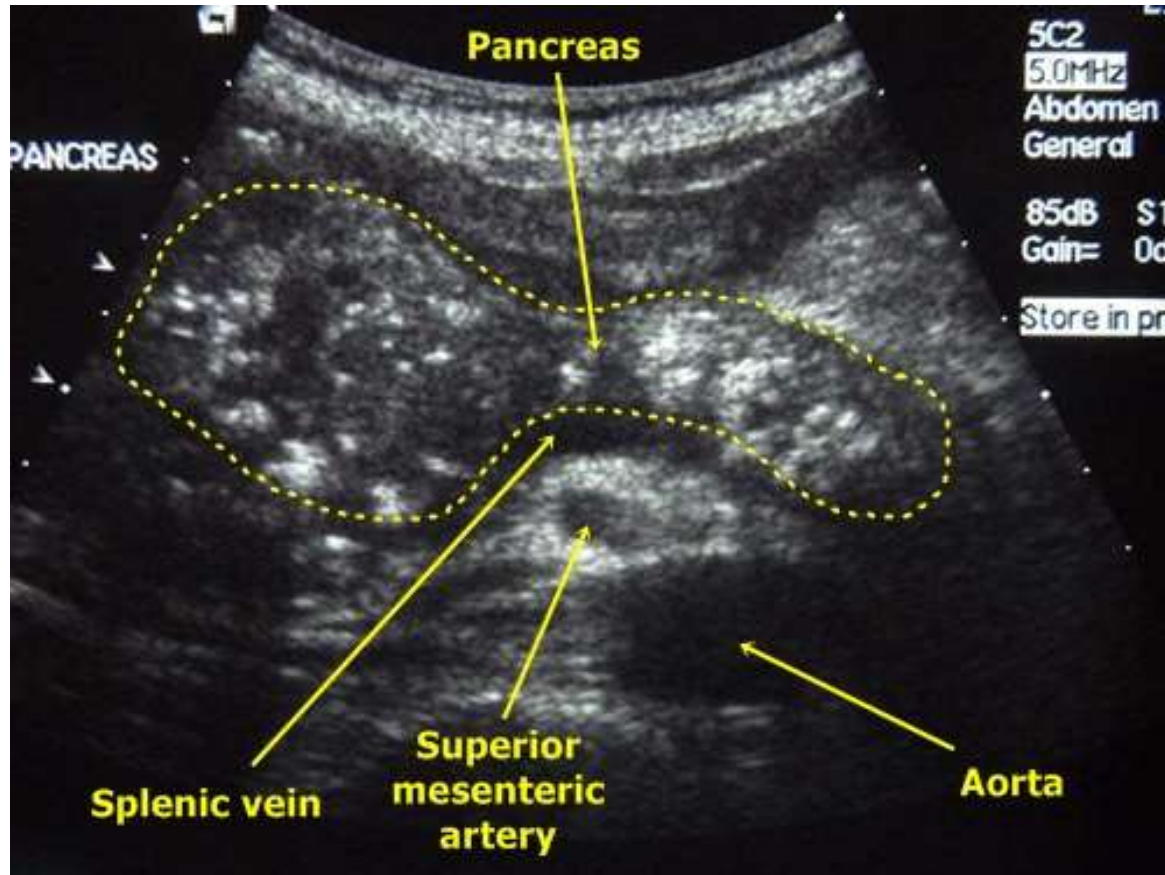
Gallstone (red arrow) within the gallbladder produces a bright surface echo and causes a dark acoustic shadow (S)

Instrumental methods: abdominal ultrasonography



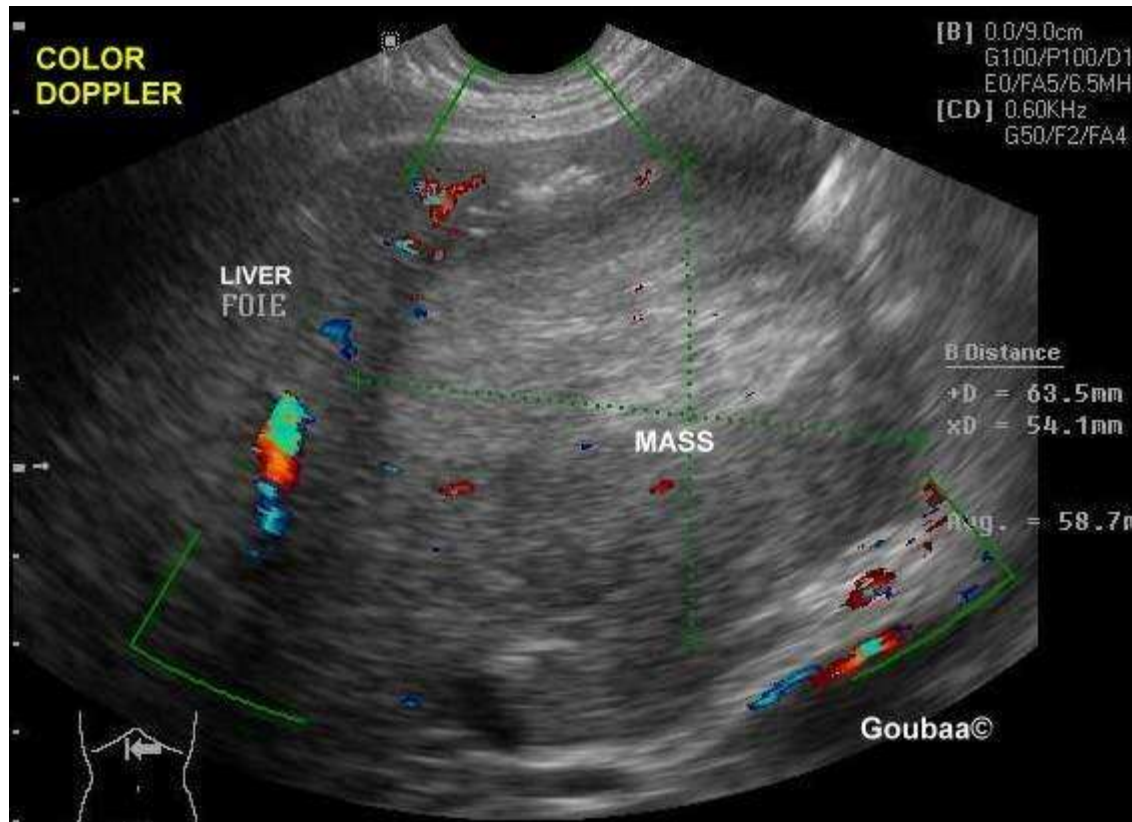
Pancreas and its proportions + neighbouring anatomical structures in classic transverse epigastric plain

Instrumental methods: abdominal ultrasonography



Granular structure of the pancreas with calcifications

Instrumental methods: color Doppler



Tumor gallbladder

Instrumental methods: endoscopic ultrasonography



Radial endoscopic ultrasound showing grossly dilated extrahepatic bile duct and dilated pancreatic duct

Instrumental methods: endoscopic retrograde cholangiopancreatography

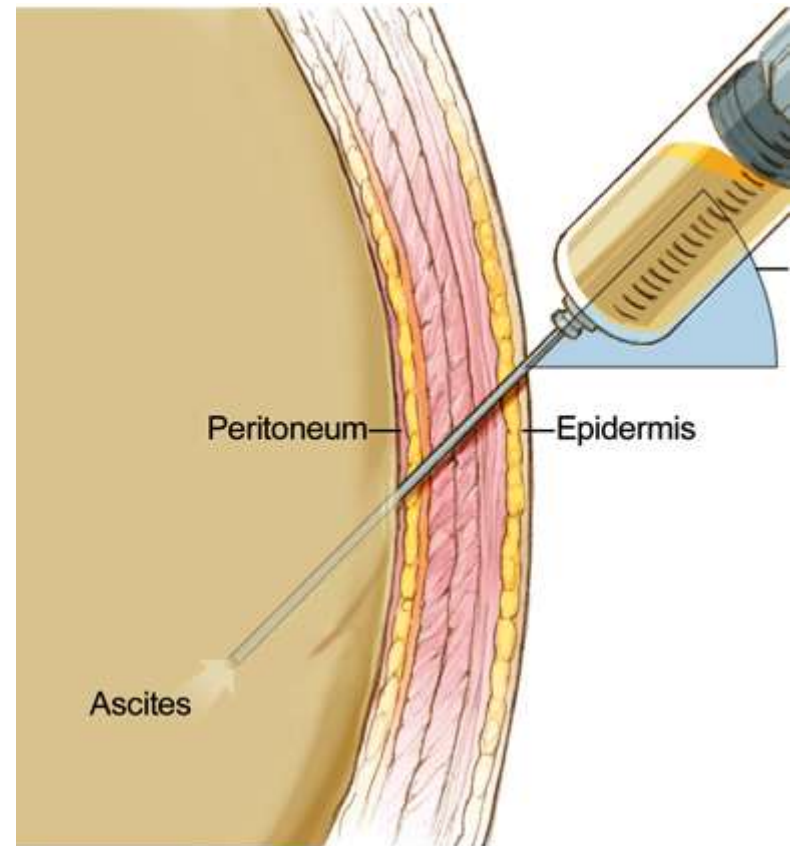
- Endoscopic retrograde cholangiopancreatography (ERCP) is a procedure for examine the pancreatic and bile ducts
- In the duodenum a small opening is identified (ampulla) and a small plastic tube (cannula) is passed through the endoscope and into this opening
- Dye (contrast material) is injected and X-rays are taken to study the ducts of the pancreas and liver



Instrumental methods: diagnostic paracentesis

Send ascetic fluid for:

- cells and differential
- chemistry (albumin, protein, amylase, triglycerides)
- culture and sensitivity and gram stain
- cytology for malignancy



Instrumental methods: liver biopsy

- Gross examination and histopathology are often definitive.
- Cytology (fine-needle aspiration), frozen section, and culture may be useful for selected patients.
- Metal content (eg, copper in suspected Wilson disease, iron in hemochromatosis) can be measured in the biopsy specimen

Generally, biopsy is indicated for suspected liver abnormalities that are not identified by less invasive methods (e.g. hepatosplenomegaly of unknown cause, unexplained liver test abnormalities) or that require histopathology for staging (chronic hepatitis, alcoholic liver disease or nonalcoholic steatosis)



laboratory methods: tests

- Blood count
- Blood sugar tests
- Blood Coagulation
- Electrolytes
- Bilirubin blood test
- Plasma proteins
- Blood ammonia
- Alkaline phosphatase
- Gamma glutamyl transferase
- Enzyme & protein blood tests
- Lipid blood tests
- C-reactive protein
- Fecal occult blood test
-



Photo courtesy of Cepheid

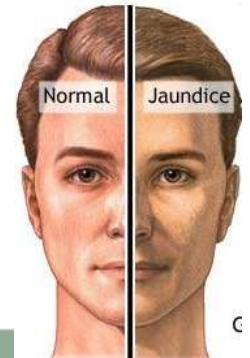
laboratory methods: blood coagulation

- A prolongation of the prothrombin time (PT) is an indicator of hepatic dysfunction as the synthesis of the coagulation factors is impaired in hepatocellular disease
 - PT is daily marker of hepatic protein synthesis (serum albumin level detects prolonged (weeks) hepatic dysfunction)
 - must exclude co-existent vitamin K deficiency
- Impaired absorption in the gut, particularly of fat soluble substances, often accompanies liver disease which may result in decreased absorption of vitamin K, needed for the production of factors II, VII, IX and X
- Dysfibrinogenemias, an interferent with fibrin-polymerization, have also been reported in severe liver disease
- Fibrinolysis is increased in some patients with hepatic disease, presumably because of reduced synthesis of plasmin inhibitors by the diseased liver

laboratory methods: bilirubin blood test

- Bilirubin is a waste product of the normal breakdown of red blood cells
- Bilirubin passes through the liver and eventually out of the body — mostly in feces, a small amount in urine
- Before reaching the liver, bilirubin is called unconjugated (uncombined)
- In the liver, bilirubin combines with certain sugars to create a water-soluble form called conjugated bilirubin
- Conjugated bilirubin passes out of the liver, and in the colon, it is converted back into the unconjugated form en route to being excreted from the body
- Amount of total bilirubin conjugated bilirubin is called direct and unconjugated bilirubin is called indirect
- Normal levels are: direct bilirubin: 0 to 0.3 mg/dL, total bilirubin: 0.3 to 1.9 mg/dL (normally, 90% or more of serum bilirubin is indirect)
- Higher than normal levels of direct or indirect bilirubin may indicate different types of liver problems
-

laboratory methods: bilirubin fractions in blood and urine



Fraction	In Serum As	Measured As	Present in Urine
Unconjugated	Albumin-bound	Indirect-reacting bilirubin	Never
Conjugated	Unbound	Direct-reacting bilirubin	Yes, when serum bilirubin level is elevated

laboratory methods: plasma proteins

- Plasma total protein concentrations in liver disease often are near normal because a decrease of albumin is offset by an increase of globulins and the concept of the ratio of albumin:globulin (A/G ratio), as used in the past, reflects this (Reference Range: 1.5:1 to 3.0:1)
- Most useful are albumin measurements in the assessment of the severity of impairment of the synthetic functions of the liver: chronic proliferative disease of the liver (cirrhosis, chronic hepatitis) leads to polyclonal hypergammaglobulinemia as demonstrated by the “beta-gamma bridging” on serum protein electrophoresis
- Albumin is also important in the evaluation of renal disease
- Reference Range: total proteins, 6.0 - 8.0 g/dL, albumin, 3.3 - 5.0 g/dL

laboratory methods: serum proteins in the diagnosis of specific disorders

- α 1 -Antitrypsin (absent in α 1 -antitrypsin deficiency)
- Ceruloplasmin (reduced in Wilson disease)
- Transferrin (saturated with iron in hemochromatosis)
- Ferritin (greatly increased in hemochromatosis)

laboratory methods: serum immunoglobulins

- IgM in primary biliary cirrhosis
- IgA in alcoholic liver disease
- IgG in autoimmune hepatitis
- IgA is affected more than other immunoglobulins because most is manufactured in lymphoid tissue of the gut

laboratory methods: serology for viral hepatitis

Hepatitis A virus (HAV)

- IgM: current infection or convalescence
- IgG: current or previous infection; confers immunity

Hepatitis B virus (HBV)

- HBsAg: surface antigen
- HBeAg: e antigen (a component of HBV core); marker of viral replication
- HBcAg: core antigen (cannot be measured in serum)
- HBsAg and HBeAg are present during acute hepatitis B
- anti-HBs follows HBsAg clearance and confers long-term immunity
- anti-HBe and anti-HBc appear during the acute and chronic phases of the illness but do not provide immunity
- anti-Hbe indicates low infectivity

Hepatitis C virus (HCV)

- HCV RNA (detected by PCR assay)
- anti-HCV
 - develops in 6-8 weeks in 85% of patients
 - persists in chronic infection and does not confer immunity

laboratory methods: blood ammonia

- Elevated blood ammonia is seen in severe liver disease and in actual or impending hepatic coma
- The elevations are due to reduced removal of ammonia from the portal blood, and "shunting" of portal blood, bypassing the liver
- Proteins absorbed in the gut first pass through the liver in the portal circulation
- Blood ammonia levels show some, but not close, correlation with the presence and deepness of the coma
- Reference Range: 10 - 35 $\mu\text{mol/L}$

laboratory methods: alkaline phosphatase

- Alkaline Phosphatase (ALP) is present in high concentration in the lining of the biliary system (bile canaliculi) and escapes into the bloodstream when the lining cells are affected by inflammation, necrosis, or obstruction
- Elevations of ALP in the blood are a sensitive indicator of a biliary process but they are also seen in liver cell damage: the higher the alkaline phosphatase, the greater the chances for post-hepatic obstruction
- It must be kept in mind that there are other important sources of ALP such as the bones and the gastrointestinal mucosa, the placenta, and certain tumors
- Reference Range: 30 - 130 U/L

laboratory methods: gamma glutamyl transferase

- Gamma glutamyl transferase (GGT) is found in liver and pancreas, but in even larger amounts in the kidney
- Elevations of the hepatic GGT can be due to a bone disease or due to cholestasis
- GGT determinations are helpful in differentiating bone and liver sources of alkaline phosphatase, since there are no significant amounts of GGT in bone
- GGT is also a sensitive indicator of alcohol-induced liver disease and of recent alcohol ingestion
- Reference Range: male, <38 U/L; female, <24 U/L

laboratory methods: other tests

- α –Fetoprotein (AFP) - primary hepatocellular carcinoma
- Antibodies:
 - antimitochondrial antibodies (autoimmune hepatitis, drug-induced hepatitis, primary biliary cirrhosis, other autoimmune disorders)
 - perinuclear antineutrophil cytoplasmic antibodies (p-ANCA) (primary sclerosing cholangitis)

laboratory methods: enzyme & protein blood tests

- Alanine Aminotransferase (ALT; also called SGPT), goal value: 5 – 50 U/L
- Aspartate Aminotransferase (AST; SGOT), goal value: 7 – 40 U/L
- Creatinine (Cr), goal value: 0.7 – 1.4 mg/dL
- Creatine Kinase (CK), goal value: 30 – 220 U/L
- Lactate dehydrogenase (LDH), goal value: 100 - 220 U/L
- Myoglobin (Mb), goal value: 30 – 90 µg/mL
- Troponin T (cTNT), goal value: 0.0 - 0.10 µg/mL

laboratory methods: lipid blood tests

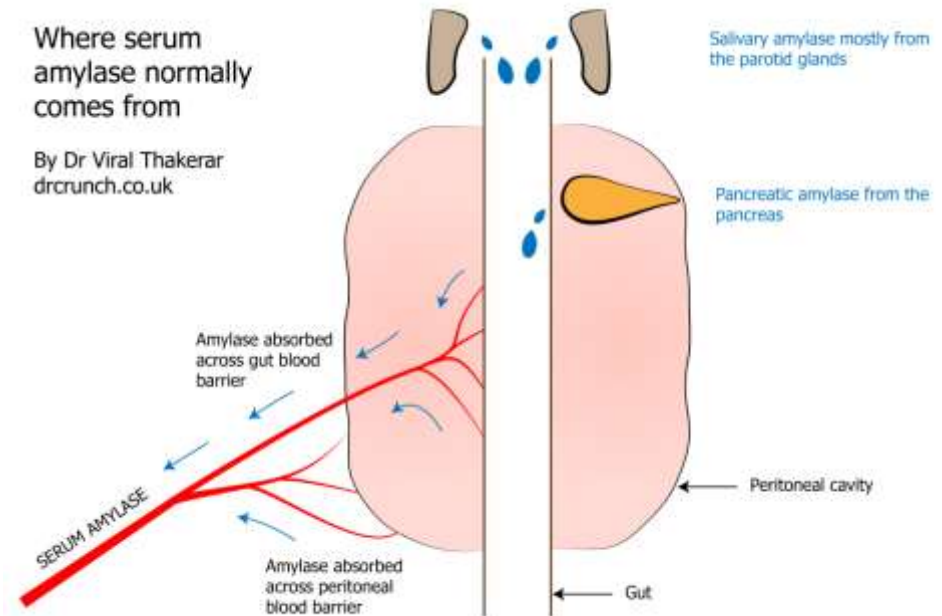
- Total cholesterol. A high level can put you at increased risk of heart disease. Ideally, total cholesterol should be below 200 milligrams per deciliter (mg/dL), or 5.2 millimoles per liter (mmol/L)
- Low-density lipoprotein (LDL) cholesterol. Too much of it in blood causes the accumulation of fatty deposits (plaques) in arteries (atherosclerosis). Ideally, your LDL cholesterol level should be less than 130 mg/dL (3.4 mmol/L), and under 100 mg/dL (2.6 mmol/L) is even better
- High-density lipoprotein (HDL) cholesterol. Ideally, your HDL cholesterol level should be 60 mg/dL (1.6 mmol/L) or higher, though it's common that HDL cholesterol is higher in women than men.
- Triglycerides. High levels increase risk of heart disease. Ideally, triglyceride level should be less than 150 mg/dL (1.7 mmol/L)

laboratory methods: C-reactive protein

- CRP is a sign of inflammation somewhere in the body
- Inflammation plays a central role in the process of atherosclerosis, in which fatty deposits clog arteries
- CRP test result can be interpreted as putting heart disease risk at:
 - Low risk (less than 1.0 milligrams per liter, or mg/L)
 - Average risk (1.0 to 3.0 mg/L)
 - High risk (above 3.0 mg/L)

laboratory methods: serum amylase and lipase

- Amylase and lipase are enzymes produced by the pancreas that help to digest food
- If the pancreas is damaged, high levels of these enzymes can be detected in the bloodstream
- Checking amylase and lipase levels can help determine if you have pancreatitis



laboratory methods: secretin stimulation test



- The secretin stimulation test measures the ability of the pancreas to respond to a hormone called secretin
- The small intestine produces secretin when partially digested food enters the area from the stomach
- Normal value ranges may vary slightly depending on the lab doing the test
- Abnormal values may mean that the pancreas is not working properly

laboratory methods:

Fecal occult blood test

- Fecal occult blood (FOB) refers to blood in the feces that is not visibly apparent (unlike other types of blood in stool such as melena or hematochezia)
- A fecal occult blood test (FOBT) checks for hidden (occult) blood in the stool (feces)
- Newer tests look for globin, DNA, or other blood factors including transferrin, while conventional stool guaiac tests look for heme

Glossary of Patients Examination with Diseases of the Liver, Bile Duct and Pancreas

[Liver, Bile Duct and Pancreas Glossary of Terms](#)